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Isolated traumatic rupture of the gallbladder

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Gallbladder injury resulting from blunt abdominal trauma is rare, being found in only about 2% of patients who undergo laparotomy for abdominal trauma. Its small size and anatomic location—partially embedded in the liver tissue, surrounded by the omentum and intestines, and overlaid by the rib cage—provides good protection.

Diagnosis can be difficult, and delay may result in the development of weight loss, nausea, vomiting, abdominal distension, jaundice, ascites, and abdominal pains. Delayed imaging with computed tomography can aid in diagnosis, especially in differentiating benign processes from true gallbladder injuries.

Treatment for gallbladder injury is most commonly cholecystectomy. Mortality rates in patients with gallbladder injuries are related to associated injuries, including cardiac, thoracic or intra-abdominal hemorrhage, or multi-organ failure and/or brain damage. In isolated gallbladder injury, the prognosis is good.

Case report

A 59-year-old male presented to the emergency department after being struck by a train. The patient was hemodynamically stable upon arrival. On physical exam, the patient was grossly intoxicated and was tender in the right upper quadrant. Initial lab results revealed an elevated blood alcohol level of 67 mmol/L, elevated AST of 59 U/L, mildly elevated WBC of $10.4 \times 10^9/\text{L}$ and an elevated lactate of 2.6 mmol/L. Normal ALP, and total bilirubin of 83 U/L and 3.6 $\mu\text{mol/L}$, respectively.

The patient received a whole body scan under the trauma protocol. Computed tomography (CT) of the abdomen in the portal venous phase revealed fluid density surrounding the gallbladder, with areas of increased at-

tenuation (Fig. 1). On delayed imaging, there was increased layering of high-attenuation material, likely representing hemorrhage (Fig. 2). Additionally, there was a focal defect in the anterior wall of the gallbladder that was thought to represent perforation of the gallbladder. The only other injury seen on the CT images was a small liver laceration.

The patient was brought to the operating room for laparoscopic removal of the gallbladder. This was converted to an open laparotomy. Rupture of the gallbladder wall was seen; however, it was contained within the peritoneal covering of the gallbladder. No frank bile was seen in the abdominal cavity. Two small superficial liver lacerations in segment 4B and segment 5, which were both near the gallbladder, were also present. Surgical pathology revealed a thickened gallbladder wall measuring up to 0.6 cm with intramural red-brown hemorrhage. The gallbladder lumen was full of clotted blood.

Discussion

Etiology & demographics

Gallbladder injury resulting from blunt abdominal trauma is rare, as the gallbladder is a well protected organ due to its relatively small size and anatomic location. It is partially embedded in the liver tissue, surrounded by the omentum and intestines, and overlaid by the rib cage (1). Because of this protection, gallbladder injuries are usually associated with injury of other abdominal organs, espe-

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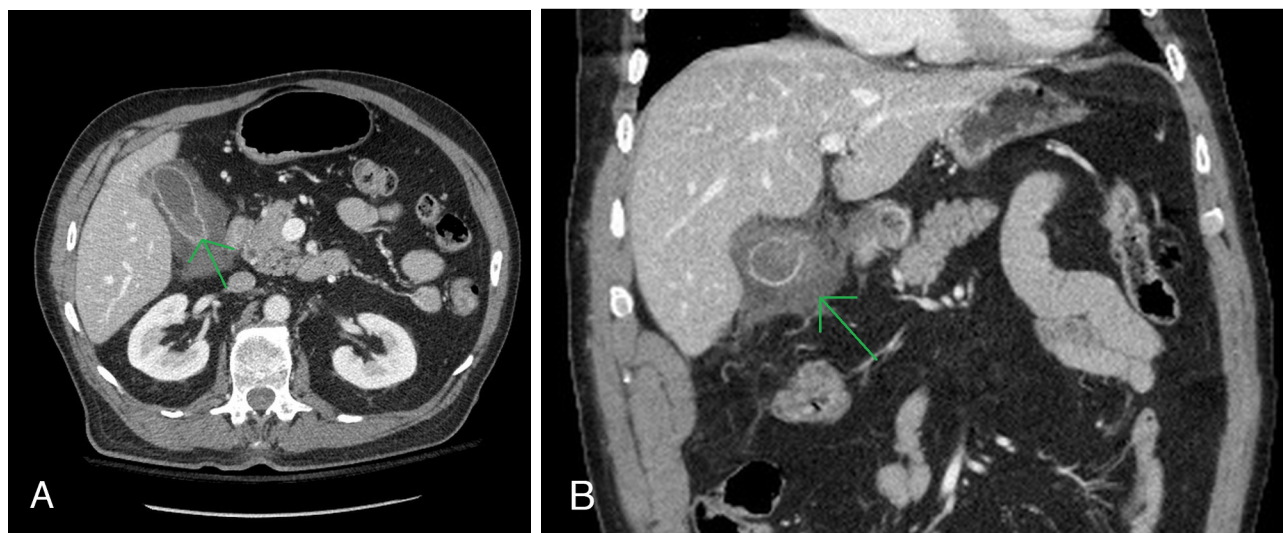


Figure 1, A and B. 59-year-old male with perforation of the gallbladder. Findings: Axial (A) and coronal (B) contrast-enhanced CT images of the abdomen through the gallbladder reveal wall thickening and focal mural disruption. Technique: Selected axial and coronal CT images of the abdomen and pelvis with IV contrast.

cially the liver (1, 2), making isolated gallbladder injury an even rarer occurrence (2, 3). Motor vehicle collisions are the most common cause of gallbladder injury, due to blunt abdominal trauma (1). Predisposing factors to gallbladder injury include a thin-walled normal gallbladder; a distended gallbladder; and alcohol ingestion (3), while a fibrotic thickened, chronically inflamed gallbladder is less likely to be

injured (4). Males are more commonly affected, with 73-89% of patients being male (1, 2), with a median age of 27 years, though wide age ranges have been reported (2, 4).

Gallbladder injuries are found in only about 2% of patients who undergo laparotomy for abdominal trauma (1). In a 13-year period at a level 1 urban trauma centre, of the over 40,000 injured patients seen, only 45 gallbladder injuries were detected. Of these patients, only 5 (11%) had suffered blunt abdominal trauma, either being struck by a vehicle or involved in a motor vehicle collision. The majority (89%) had experienced penetrating trauma, highlighting the rare occurrence of gallbladder injury as a result of blunt abdominal trauma (2). Gallbladder injuries rarely occur in isolation; most occur in conjunction with liver injury, with incidences reported at 83% to 91%. Associated injury to the spleen and duodenum are also common, in up to 54% of patients (1, 3, 5).

Classification of gallbladder injuries

Gallbladder injuries can be classified as contusion, perforation, or avulsion. Contusion is defined as an intramural hematoma. It is most often diagnosed at the time of laparotomy, and is thought to be underreported. Perforation, also referred to as rupture or laceration, is the most common gallbladder injury reported. Avulsion injuries are divided into three subtypes. In partial avulsion, the gallbladder is partially detached from the liver bed. In complete avulsion, the gallbladder is completely detached from the liver bed, but the cystic duct and artery remain intact. Total avulsion is when the gallbladder is free in the abdomen without any attachments (2, 3, 6).

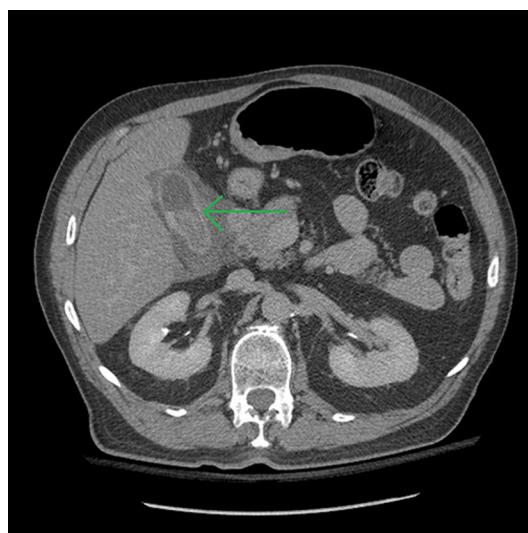


Figure 2. 59-year-old male with perforation of the gallbladder. Findings: Axial contrast-enhanced CT image of the abdomen through the gallbladder in the delayed phase demonstrates increasing density within the gallbladder representing accumulating blood within the gallbladder. Technique: Axial CT image of the abdomen and pelvis with IV contrast performed in the delayed phase.

Isolated traumatic rupture of the gallbladder

Characteristic	Details
Etiology	Primarily motor vehicle collisions (1)
Incidence	2% from blunt abdominal trauma (not isolated) (1)
Gender ratio	Males 73-89% (1, 2, 4)
Age predilection	Mean age 27 (2), range 6-74, rarely <18 (4)
Risk factors	1. Thin-walled normal gallbladder 2. Distended gallbladder 3. Alcohol ingestion (3, 4)
Commonly associated injuries	Liver, small bowel, spleen, kidney, pancreas, abdominal vascular injury (1, 2)
Treatment	Cholecystectomy (1-4, 6)
Prognosis	Mortality 24% related to associated injury (2); in isolated injury, prognosis is good (1, 6, 7)
Imaging findings	Increasing dense fluid in the gallbladder seen on CT with delayed images (3, 6)

Table 1. Summary: Several key points regarding gallbladder injury.

Table 2. Imaging findings of various gallbladder insults. Differential diagnosis of gallbladder injury with imaging findings between true traumatic gallbladder injury, and other relatively benign processes.

	Imaging findings	
Differential diagnosis	CT	CT with delayed images
Gallbladder injury	Hyperdense material within gallbladder lumen on CT (6)	Amount of hyperdense material increases (6)
Cholelithiasis	Hyperdense material within gallbladder lumen on CT (6)	Hyperdense material within gallbladder lumen on CT (6)
Vicarious contrast excretion	Hyperdense material within gallbladder lumen on CT (6)	Hyperdense material within gallbladder lumen on CT (6)
Milk-of-calcium bile	Hyperdense material within gallbladder lumen on CT (6)	Hyperdense material within gallbladder lumen on CT (6)

Clinical & imaging findings

Diagnosis of gallbladder injury can often be difficult. The diagnosis can be made by detection of blood in the gallbladder lumen. Echogenic fluid can be detected using ultrasound. With CT, high-density fluid within the lumen, thickening or indistinctiveness of the gallbladder wall, and active arterial extravasation into the lumen suggest gallbladder injury (3, 6). Delayed imaging can be useful in differentiating between relatively benign gallbladder processes and true gallbladder injuries. An increasing amount of dense fluid in the gallbladder on delayed images is consistent with true gallbladder trauma; with more benign processes, the dense fluid remains stable (6). CT is the imaging modality of choice for detecting gallbladder injury (3, 5, 6).

Diagnosis of gallbladder injury is often not made until abdominal exploration, often indicated for associated intra-abdominal injuries. Pre-operative diagnosis can, at times, be made with various imaging techniques (4). Patients may present with hemodynamic instability and an acute abdomen, often related to concurrent intra-abdominal injuries (2). More commonly in patients with isolated gallbladder injuries, presentation is nonspecific and delayed. In the period shortly after trauma, the leakage of bile (most likely sterile in blunt trauma) is not sufficiently toxic to the peritoneum (1, 4). Laboratory tests may often be normal (3, 4, 7). Peritoneal lavage may aid in diagnosis. Presence of bile in the peritoneal fluid is consistent with gallbladder trauma, but can also occur with injury to the duodenum; however, absence of bile does not rule out gallbladder injury (1, 4).

Differential diagnosis

Differential diagnosis includes traumatic gallbladder injury, cholelithiasis, milk-of-calcium bile, and vicarious contrast excretion (6).

Treatment & prognosis

Gallbladder injury is potentially life-threatening, and early diagnosis is important. Without early detection, peritonitis may develop over the course of weeks, and a patient may present with weight loss, nausea, vomiting, abdominal distension, jaundice, ascites, low-grade fever, and abdomi-

nal pains (1, 7). Mortality in patients with gallbladder injuries is related to associated injuries. One series reports a mortality rate of 24% (11/45), with these patients dying as a result of unresuscitable cardiac, thoracic, or intra-abdominal vascular hemorrhage, multi-organ failure, and/or brain damage, consistent with other series (1, 2). Fortunately, the mortality rate from isolated gallbladder injury is very low. The prognosis for gallbladder injury, with early detection and lack of other severe associated injuries, remains quite good (1, 4, 7). The preferred treatment of gallbladder injury is most often cholecystectomy, with favorable results (1, 2, 3, 4, 6).

Teaching point

Diagnosis of gallbladder injury can be difficult, but CT with delayed images is helpful in identifying and in differentiating true gallbladder injuries from more benign processes. Cholecystectomy is the preferred treatment, and prognosis in isolated gallbladder injury remains favorable.

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